Inventory of Microbial Diversity in Black Pond Samples from Lake Joyce in Antarctica

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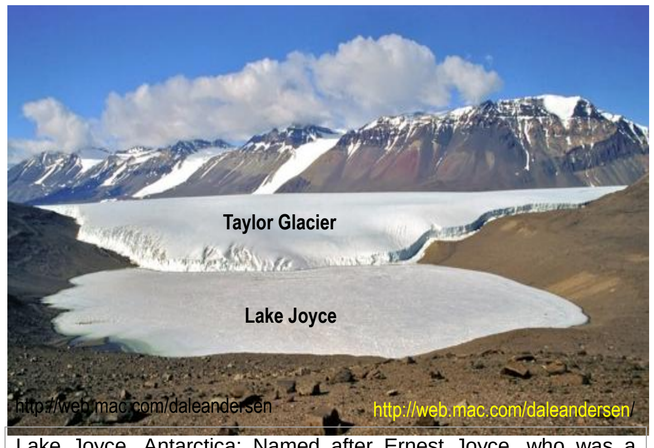
Lake Joyce

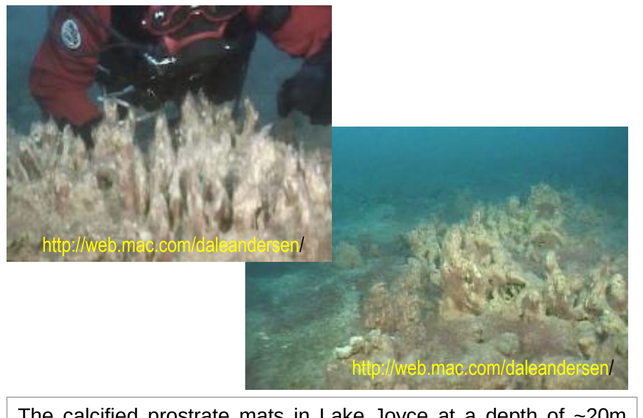
Lake Joyce (latitude -77.72˚ , longitude 161.58) located in Pearse Valley, north-northwest of Taylor Glacier is a pro-glacial permanently ice-covered meromictic lake with a maximum depth of 40 m. The ice layer that covers the lake is 5-6 meters thick. The lake receives melt-water from Catspaw and Stocking Glaciers, as well as direct runoff from Taylor Glacier.

Landsat Image Mosaic of a portion of the McMurdo Dry Valleys and Ross Island, Antarctica (LIMA) showing the Taylor Valley and the Lake Joyce.



Lake Joyce, Antarctica: Named after Ernest Joyce, who was a member of early British Antarctic Expeditions. This image is looking ESE. Taylor Glacier is in the background, damming Lake Joyce.

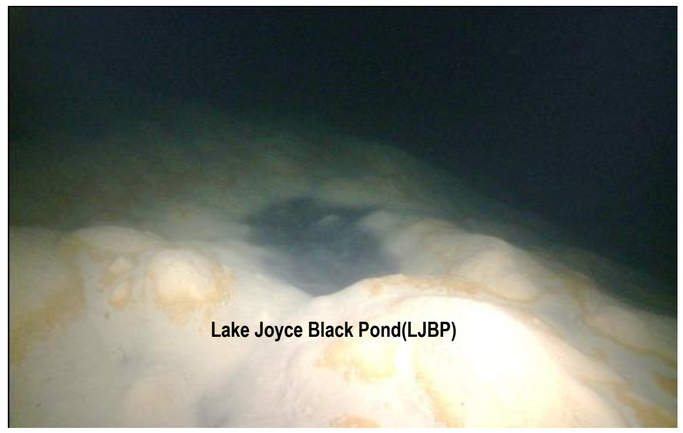
Direct observation of the benthic microbial communities conducted in *Lake Joyce* in 1998, 2009 and 2010 by Dale Andersen revealed distinct bands of highly calcified prostrate mats at a depth of ~20 m. These mats form distinct peaks rising up to 25 cm from the bottom.



The calcified prostrate mats in Lake Joyce at a depth of ~20m rising up to 25 cm from the bottom of the lake observed by Dale Andersen.

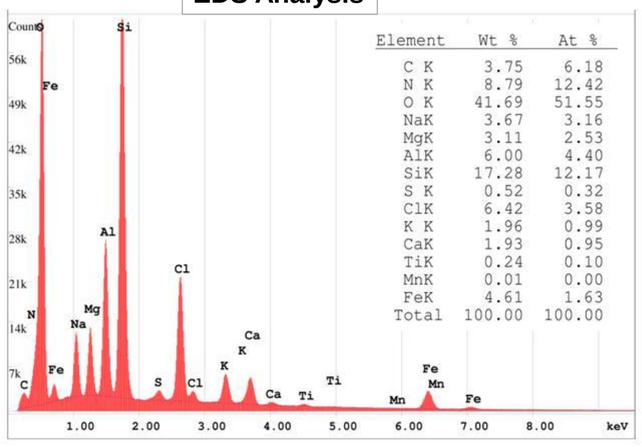
Black Pond

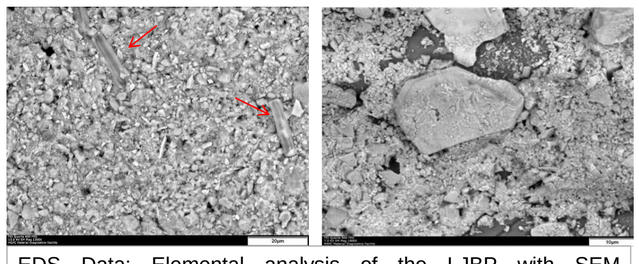
During direct observation of the benthic microbial mats, pits with dark colored precipitation at the depth of ~27.7m (aphotic and anoxic zone) were discovered. We referred these dark pits as the “Lake Joyce Black Ponds” or “LJBP”. We have made preliminary assessment of the microbiology of the LJBP samples.



The Black Pond in Lake Joyce showing accumulation of deep purple/blue precipitation. The LJBP is an anoxic zone.

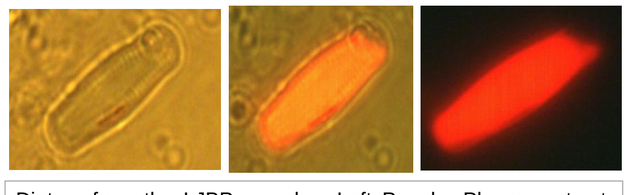
EDS Analysis





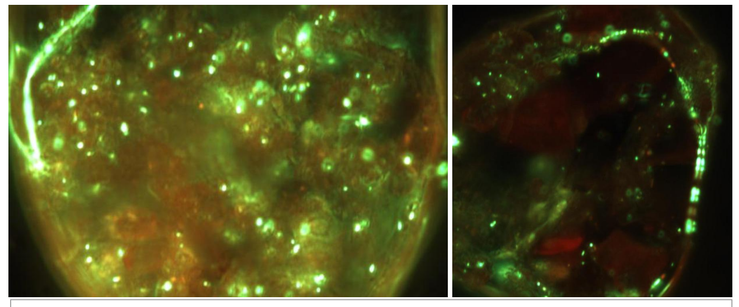
EDS Data: Elemental analysis of the LJBP with SEM micrographs. Note the diatom in the left panel of the SEM picture.

Microscopic Observation



Diatom from the LJBP samples: Left Panel - Phase contrast; Middle Panel – Phase contrast combined with epifluorescent observation; Right Panel – Epifluorescent observation Magnification = 100x

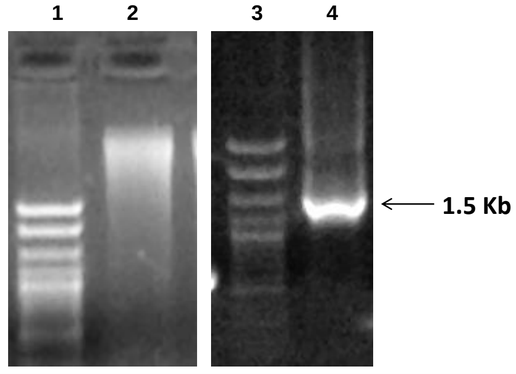
We thank N. Mojib and J. Huang for assisting us with the study; Jordan Watson and al science support members at the Crary Lab for their help.



BacLight™ fluorescent stain (Molecular Probes) of the LJBP samples showing the heterotrophic bacteria (mostly green), cyanobacteria (light red) and diatoms (dark red).

DNA Analysis

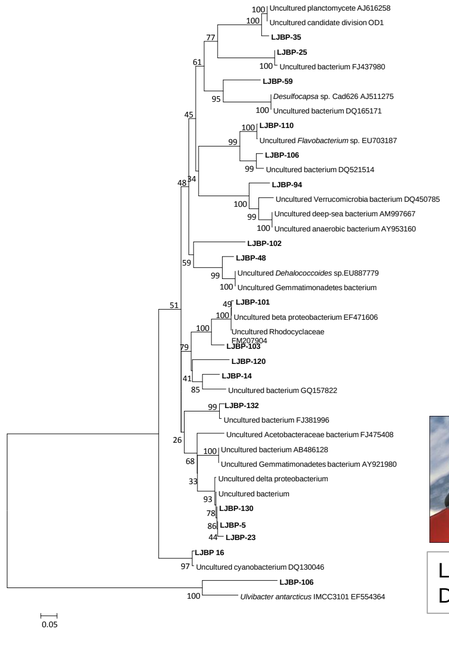
Community DNA was purified from the LJBP samples using the MoBio Power Biofilm™ DNA isolation kit and PCR amplification was performed using primers specific for the eubacterial 16S rRNA gene. The objective was to study the heterotrophic bacteria in the LJBP.



Left Panel: Purified community DNA from LJBP sample (Lane 2); DNA size standard (Lane 1). **Right Panel:** PCR amplified 1.5 kbp conserved segment of the eubacterial 16S rRNA gene (Lane 4); DNA size standard (Lane 3).

Parameters	LJBP
Total DNA isolation (MoBio Power Biofilm ™ kit)	++
Inhibition from sample	+
PCR amplification:Bacterial universal 16S rRNA primers	+++
Cyanobacteria specific primers	+
Chlorophyll a content	0.29 µg/g

Phylogenetic Analysis



PCR amplified community DNA was cloned to establish a clone library. Cloned 16S rRNA gene was sequenced (50 clones were sequenced); similarity index was determined by Blast analysis (NCBI) and phylogenetic tree was determined using the MEGA 4 software. LJBP=Lake Joyce black pond clones. Note that LJBP 16 clone showed sequence homology with an uncultured cyanobacteria.

Left to right: Dale Andersen, Dawn Sumner; Asim Bej